sure is relieved, the pain remits in intensity, the remission being directly as to the length of time required for the passing of the congestion. During paroxysms or stage of retention, the cephalgia changes its character to an intense sickening and throbbing, synchronous with the heart beat, while during the stage of quiescence, it assumes more the character of a heavy pressure upon the vertex. The periodicity of recurrence is not typical as in the frontal, but seems to come on at any time of the day and does not remit with that abruptness as is so often noted with the latter.

Another curious phase of the pain is its occasional appearance directly below the eye, in the region of the infra-orbital nerve.

Dizziness, especially on stooping, is more frequently associated with pain from the sphenoidal sinus than from any of the others and when marked, is rather indicative of inflammatory disturbances within this cavity.

And now, Gentlemen, I am done. In conclusion, however, it would seem that headache is one of the most common of all the symptoms associated with a chronic sinusitis and that the time, place and degree of these head pains, properly interpreted, despite their vagaries, constitute one of the most reliable signs in the symptomatic diagnosis pertaining to sinuology.

OCULAR HEADACHES

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Who first realized that head-pain was one of the interpretations of defective refractive power of the human eyes is not known.

It is possible that when, more than six hundred years ago, Roger Bacon, after describing the properties of a convex lens, wrote, "and therefore this instrument is useful to the aged and to those having weak eyes, for they can see any letter, howsoever small, of a sufficient magnitude," he may have noted headache as a symptom and tied up his observation in a cipher, as was his

wont. Doubtless the *doctor mirabilis* made the eyes of many a colleague grown old and dim in service see the finest of letters, and relieved the distress of which six centuries before Ætius wrote, but could not explain.

At all events, he recognized asthenopia, although he did not invent this title, which is still in constant use to describe a lot of symptoms, the major ones of which are a sense of strain and weariness in the head and eyes caused by visual effort, especially at close ranges.

At first "this condition was considered as a sort of amblyopia," and in the century prior to Donders' important observations, to use his own words, "neither the nature nor the causes of the phenomena of asthenopia had been fully ascertained, notwithstanding many endeavors to investigate them."

The early writers often recorded an accurate description of asthenopia, but curiously enough, although it must have been observed, headache, as we understand it, is practically never mentioned. "Uneasiness about the forehead" (Taylor's phrase); "tension above the eyes"; or "tension above the eyes which gives place to actual pain," are the expression one finds. But sixty-four years ago, after an elaborate study of this condition, Donders wrote: "Hypermetropia is usually at the bottom of asthenopia. . . . I venture to maintain that in the pure form of asthenopia, hypermetropia is scarcely ever wanting."

It is true, as Donders himself states, that von Graefe was on the point of thinking of hypermetropia in its proper relation to asthenopia, but he didn't quite hit the mark, and to the learned professor of ophthalmology and physiology in Utrecht belongs the credit of revealing the significance of the muscular strain which is occasioned by the hyperopic eye, and of explaining that to this constant muscular effort are due the pain, misery and asthenopia of its subjects and that proper glasses afforded the necessary relief.

After this discovery it was no longer necessary to follow Mackensie's suggestion that as asthenopes "never could employ their eyes advantageously in reading and writing, they might see sufficiently to follow the pastoral pursuits of an Australian colonist."

As time went on, systematic writers established various types of asthenopia, to wit., asthenopia simplex, dolens, cephalalgica irritans, etc., not to mention accomodative, muscular and neurasthenic "weak sight."

Soon the term "eye-strain" came into existence, and now almost universally used, although not quite to the exclusion of "asthenopia," is a term which interprets the varied general and local manifestations of refractive error, exterior ocular muscle imbalance and accommodative dysfunction. The list is a very long one.

With full recognition and admiration of the work of Donders, Graefe and the earlier writers, it is a matter of congratulation that the widespread influence of eye-strain was first recognized by American physicians, and our real knowledge of this matter is due to the genius of Weir Mitchell and the labors of William Thomson and Ezra Dyer. It constitutes a discovery, or at least, a realization which in so far as the relief of human suffering and the sum of human happiness are concerned, deserves to rank with the best scientific announcements of the nineteenth century. Listen to the proclamation of more than fifty years ago:

"(1) What I desire, therefore," wrote Weir Mitchell in 1872, "to make clear to the profession at large is that there are many headaches which are due to the disorders of the refractive or accommodative apparatus of the eyes; (2) that in these instances the brain symptom is often a most prominent and sometimes the sole prominent symptom of the eye troubles, so that while there may be no pain or sense of fatigue in the eye, the strain with which it is used may be interpreted solely by occipital and frontal headaches; (3) that the long continuance of eye troubles may be the unsuspected source of insomnia, vertigo, nausea and general failure of health; (4) that in many cases the eye trouble becomes suddenly mischievous owing to some failure of the general health, or to the increased sensitiveness of the brain from moral or mental cause." We have elaborated our methods, improved our instruments of precision and extended the list of interpretations of eye-strain, but otherwise we have been able to add but little to this complete and compact presentation of the facts of the case.

Of the varied and numerous exhibitions of eye-strain, we are,

as I understand the matter, confining ourselves this evening to one conspicuous symptom, namely, headache.

Frequency. The literature is replete with statistical information relating to the frequency of headache due to ocular defects, and this term includes refractive errors and the various types of heterophoria and abnormal accommodation. It would serve no useful purpose to review the tabulations in this respect. Suffice it to say that from thirty to sixty per cent. of functional headache are wholly or in part due to eye-strain in the widest acceptation of that term.

Whether this refractive error or muscle imbalance is the more potent factor is not determined, or at least, differences of opinion exist. Long ago Weir Mitchell was impressed with the influence of muscle defects, and so good an observer as Marlow believes that heterophoria is more apt to produce headache than ametropia. It is difficult to be exact in these circumstances, as the conditions are almost always in combination, and after all, it makes very little difference, as the careful investigator of the etiology of cephalalgia always takes all factors into consideration.

The type of ametropia and heterophoria in relation to headache. While it is true that any type of refractive error may be the cause of headache, it is well known that simple myopia is least frequently concerned, while astigmatism, with or without hyperopia, most commonly is the causative agent; simple and compound myopic astigmatism holds an intermediate position.

(1) The ophthalmologist is constantly asked this question: "Has my patient enough refractive error to account for headache?" And it is not uncommon to encounter the belief among the laity and among physicians that the refractive anomaly must be considerable before it can provoke head-pain. This is all wrong. Small, very small, degrees of ametropia, especially astigmatism, are frequent headache-producers, more frequent, in fact than the large errors. This fact is worthy of emphasis.

(2) Another important point is this, namely, that ocular headache and pain in the eyes are often unassociated. "Doctor, I am subject to severe headache, but it can't be my eyes, for they never pain, no matter how much nor how long I read," is a sentence that must be familiar to all of us.

Long ago Donders, referring to asthenopia, noted this fact: "It is remarkable," he writes, "that pain in the eyes themselves, even after continued exertion, is of rare occurrence." It is perhaps too much to say that it is "of *rare* occurrence"; but this disassociation is certainly quite common, and often diverts the examiner from the true causes of the headache.

(3) Physical vigor and welfare do not necessarily exempt their possessor from ocular headache, even when the refractive defect is a small one. "It is absurd," says some young Hercules, "to blame my eyes for my frequent headaches; I can see like a hawk and am as strong as an ox." Suspect this patient; examine his eye *secundum artem;* the correction of a fraction of a diopter of astigmatism may be the required therapeutic measure.

(4) On the other hand, and not infrequently, precisely the reverse is true. Weir Mitchell did not miss this point when, fifty-three years ago, he said, "in many cases the eye troubles, *i.e.*, eye-strain, headache, become suddenly mischievous, owing to some failure of general health, or to the increased sensitiveness of the brain from moral or mental causes." The clinical histories of supposed eye-strain patients should always be taken carefully, and often this relationship will be discovered; many of them with acquired lowered resistance in the manner described need treatment and management from the general as well as the ocular standpoint; combined, such treatments may be effective; uncombined, defective.

(5) The statements just made suggest another clinical fact, namely, that many patients have "two or even three kinds" of headache, as Mitchell was wont to say. Not infrequently the subject is able to differentiate them. "The headache I had yesterday," he remarks, "was not from my eyes; I can always know when my eyes are at fault." All this may seem very trivial, and yet I think it is not, even though it is so well known, because disregarding it may readily lead the physician into error, causing him to stray from the proper avenues of therapeutic effort. Naturally, these complex, often recurring headaches may have a much wider significance, which is not now in discussion.

(6) Has eye-strain headache distinctive features? Suggestive they certainly may be, but not pathognomonic. The frontal re-

gion is probably most frequently selected, but the pain may be situated in the temples, the parietal or occipital region, or at the vertex. Briefly, the headache may vary from a moderate frontal distress to violent explosions of pain, and may be localized in any portion of the cranium, and may or may not be associated with nausea and vomiting; a large percentage of the so-called "bilious headaches" are of ocular origin, and the head-pain often is migrainal in type. True migrain, however, is never, I believe, solely due to eye-strain, although this may be, and often is, an important factor in the complex etiology of this disease entity, and the most painstaking and repeated investigation of refractive error and heterophoria is an essential part of its management.

The attempt to classify headaches with relation to their supposed etiology according to their manifestations, is praiseworthy, and much has been written on the subject. But it is not a dependable method of diagnosis, and it is not safe to be satisfied with "he has a typical eye-strain headache," "a characteristic hypertension headache," a "representative gastric headache," a marked "pituitary body headache," etc. Eye-strain is a notable mimic, and constantly originates head-pains which resemble closely those usually ascribed to other causes. This is a rather trite statement, and yet not without its value. The lesson is obvious, and further comment would seem to be unnecessary.

(7) An attempt has been made to differentiate the headache due to refractive error and those caused by heterophoria, for example, accusing errors of refraction of pain in the anterior portions of the cranium and various types of heterophoria, especially anomalies of convergence, of occipital distress. Freely admitting that convergence insufficiency often causes occipital headache, I question whether the distinction just mentioned can be maintained with accuracy.

Of course all types of heterophoria, either alone or associated with refractive error, are headache-producers, and may have favorite areas of the cranium for their activities, for example, the one just named, or the common brow pain above the hyperphoric eye, or the temporal and tempero-parietal aches associated with esophoria, etc. The point simply is that these are often suggestive localizations, but nothing more.

Although the act of reading, or performing any sustained piece of work at close ranges, may cause headache in a few minutes, the pain is often delayed for long periods of time, a common example being the morning headache which follows the evening reading. An interesting eye-strain phenomenon is one which may be called its "cumulative action," perhaps most conspicuously manifested in the freedom from headache during the week's work, but its arrival at the end of this period, the so-called Sunday headache. Probably in minor degree this type of headache is evident at the close of the day's labor. "My head begins to ache about four o'clock each afternoon," is a common statement.

(8) Naturally, the incidence of ocular headache does not depend alone upon eye work at close ranges. Car sickness and headache (even if reading has been omitted), the shopping, cinema, and automobile headaches are in the majority of instances due to eye-strain.

Those which are ascribed to attendance at the theatres, or a motion-picture hall, are especially prone to occur if hyperphoria is associated with refractive error, particularly if the gaze must be directed somewhat upward. This was recognized by the English Commission which investigated the ocular harm caused by the "pictures," as they are colloquially named in Great Britain.

(9) *Contributing Factors.* Mention has been made of the fact that many patients suffer from several kinds of headache, and if therapeutic success is to be achieved, each factor must be eliminated. But many pure eye-strain headaches apparently continue even though the eye faults have been most accurately corrected. The failure of optical therapy in these instances often depends upon the surroundings of the patient during his working hours, and notable contributing factors are glare, imperfect illumination, unhygienic conditions and impure air. Too often the physician disregards this cause, and the patient thinks, or perhaps is encouraged to think, that the "glasses are wrong," to use a common expression. Our duty is not strictly performed unless we ascertain exactly under what conditions the patient is employed. An alteration of illumination, an eye shade, an improvement in ventilation may be all that is required. Glare is a particularly

mischievous factor, and it is popularly believed that irritating rays passing to the retina are blameworthy. In point of fact, the pain it causes is largely, if not entirely, due to periorbital muscular compression, especially against the supraorbital notch; it is really a pressure pain.

Naturally, glare-pain and headache may require the use of variously tinted spectacles, but it would seem their employment is rather overdone, and in this respect eyes are too frequently coddled. In most instances the tinted lenses should be worn when the need is evident, but in usual circumstances the ordinary glasses be employed. Exclusive of glare, "the blessing of the sunlight" should not be disregarded. It is easy to create an undue sensitiveness to ordinary light, which has not previously existed.

Often headache is the only interpretation of eye-strain, but not infrequently, as already noted, it is only one of the causes, that is, the patient is the subject of several kinds of head-pain, depending upon other etiologic factors, organic and otherwise.

But ocular headache may be, and not uncommonly is, only one link in the chain of the so-called eye-strain reflexes. Excluding the usual local manifestations, to wit., blepharospasm, conjunctival congestions, blepharitis, styes, chalazia, etc., we recognize eccentric poses of the head, distortion of the features, especially wrinkling of the forehead, contraction of the sternoclinomastoid, and tilting of one or other shoulder, even lateral curvature of the spine. In the latter circumstances, various types of heterophoria, notably hyperphoria and anomalies of the action of the obliques, maintain conspicuous import.

Finally comes the long list of all manner of reflex disturbances: vertigo, one variety being characterized by a sense of falling forward when walking in a crowd, associated with confusion of ideas; drowsiness, and, on the other hand, insomnia, timidity, night terrors and evil dreams; pseudo-chorea, habit-spasm, epileptiform convulsions, melancholia and neurasthenia; flatulent and other types of dyspepsia; indigestion and constipation; pains strangely and persistently situated in the nape of the neck, between the shoulder-blades, in the precordium, at the end of the spine, and deep in the mastoid. This category could easily be

enlarged; this record is sufficient and serves its purpose to indicate that many symptoms, apparently totally unrelated to the eyes, may none the less be the result of eye-strain, and be associated, as has been said, with the headaches which are now chiefly in consideration.

Fully aware that such phenomena, headache and the conditions which have been catalogued, are frequently due to causes other than ocular strain, earnestly deprecating incomplete investigation from all standpoints, and entirely conscious of the fact that the whole matter has not always escaped exaggeration, it is definitely the duty of physicians to recognize the relation of eye-strain to all of these and allied phenomena, and to eliminate it as an etiologic factor. In summary, then, these are the facts:

Eye-strain due to refractive error, heterophoria and accommodative dysfunction is responsible, in whole or in part, for about 60 per cent. of functional headaches; small errors of refraction are often more potent in this respect than the larger ones; all types of refractive anomalies and heterophoria are capable of causing headache; but in the list of errors of refraction, simple and compound astigmatism and hyperopia are the most potent; the eyes themselves may be free from pain, and the headache none the less be ocular in origin; physical vigor does not exempt the patient from ocular headache, although often such headaches do not appear until physical and mental power fail; there are no pathognomonic features of eye headache; they may be suggestive, not more; they may be situated in any portion of the cranium and be of any degree of intensity, and may closely resemble those usually ascribed to other causes; they may immediately follow eye effort, or be apparent only long after the ocular work is completed; eye work at close ranges is not a *sine qua non* of their development; long distance ocular effort may be equally effective; ocular headaches may be acute, sometimes chronic, but chronicity is usually suggestive of some other factor, direct or contributing; there may be recurrences of periodic eye headache, which appear at times to exercise a certain quality of selection with respect to its "agent provocateur," thus, for example, writing may be pursued with impunity, but reading invariably and quickly produce head-pain, moreover, in exactly similar circumstances.

The cure of eye-strain headache depends in largest measure on the measurement and adjustment of suitable lenses. The correction of errors of refraction and muscle balance is an art and a science. It must never be slovenly, never careless. To fail in these respects is just as reprehensible as would be the administration of wrong doses of a remedial agent, or faults in the technic of a delicate surgical operation. We are not, however, discussing treatment, as I understand it, this evening; also this largely concerns the conscience and work of the ophthalmologist.

But with the expression of one thought I desire to close this paper, which naturally has dealt in homely phraseology, only with the repetition of well-known facts and the record of universal experience and observation, to wit., that in many of the eye-strain problems the general physician and those trained along special lines should work together to the same end, exactly as they do in many diseases of the eyes. Such "eye-strain problems" may be complex; if so, cooperation is the master word. Therapeutic success is what we desire; we shall achieve it in complicated circumstances if we labor, to use Ruskin's oft-quoted words, "in perfect sympathy and uncontending equity."

HEADACHE FROM THE VIEWPOINT OF THE INTERNIST

LUDWIG KAST

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Until the different mechanisms producing headaches are all known it is impossible to give an etiological or pathological classification of them. From the internist point of view it is therefore still necessary to resort to clinical classifications in order to get some order into the great varieties of headaches.

Eliminating from discussion headaches due to *trauma* and simple *symptomatic,* transitory headaches which accompany acute fevers (scarlet fever, measles, influenza, pneumonia, typhoid, malaria, erisypelas, acute indigestion, etc.), all others may be divided into extracranial and intracranial.